

# CONSTRUCTING BAT-FRIENDLY GATES

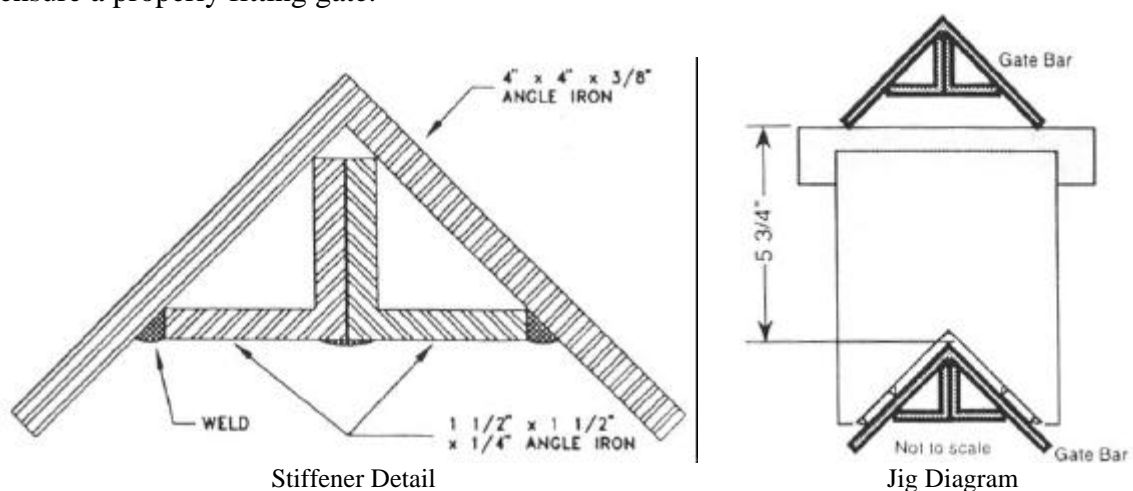
## TIMPANOGOS CAVE NATIONAL MONUMENT

New gates will be constructed on the three natural entrances to the Timpanogos Cave System that will provide the maximum security for cave resources while minimizing the negative effects on the cave's ecology. The issues involved are gate's strength, preserving cave resources, access problems, project's timeline, and safety.

The gates must be strong enough to provide security to the cave resources. The gates will be constructed using 4-inch flange angle iron bars with a 3/8-inch wall thickness. These bars are reinforced by welding two 1-1/2 inch angle iron bars in the inside (See Stiffener Detail). The bars then will be leveled and welded to 1 inch steel pins that are pressure fitted into 6-8 inch drilled holes in the walls. This style gate has been proven as a deterrent to vandalism.

The cave gates must be located, designed, and constructed to protect the cave's ecology by restoring the cave's natural airflow, maximizing the ease of bat passage, and eliminating chances of bat predation. The bar width will more than 24 inches in length (Hathorn & Thornton 1985?, Tuttle 1977). The bars will be placed perfectly horizontal and spaced every 5-3/4 inches (See Spacing Jig Diagram) (Nieland 1997, Hathorn & Thornton 1985?). This size should restrict 98 to 95% of human entry, but be enough spacing that bats will not reduce their air speed of entry or exit (Nieland 1997, Hathorn & Thornton 1985?). The gates will be located where the opening between the gate's bars will be greater than the entrance's smallest restriction (Nieland 1997, Hathorn & Thornton 1985?). The gates will be located near the dark zone where the bat's risk from predators can be reduced (Nieland 1997, Tuttle 1977). By following these specifications, the monument will have gates that protect the cave's ecology.

The gates must be constructed to fit the cave. The walls of the cave can't be modified to fit improperly measured parts. The gate will be manufactured bar by bar. A bar will be measured, cut, and welded into place before moving to the next bar. This process will ensure a properly fitting gate.



The monument will assist in delivering materials and equipment to the sites. The monument has a modified mining cart known as the “buggy” to transport equipment to the cave. The buggy can transport up to load up to about 500 lbs. The angle iron beams will have to cut to 10-ft lengths to fit in the buggy. Other materials and equipment will have to fit into the cart of the buggy. This cart is 3-ft wide, 4-ft long, and stands 2½-ft high.

The construction of gates could begin when the caves are accessible by buggy or ATV. The estimated date is May 1<sup>st</sup>. The cave is expected to open on Saturday, May 4<sup>th</sup>. Special arrangements (working at night) must be made to “dodge” tours.

Measures must be taken to assure safety to working crews and visitors. The work will involve exposures to welding and cutting gases and working on vertical cliffs. Safety measures such as running generators and acetylene torches outside of the cave and using proper rope and harness safety techniques are needed. The contractor will coordinate work with monument staff to assure safety to monument staff and visitors. Following these guideline, we will have an accident free project.

### **Hansen Cave Gate**

This gate will require replacing the existing bars above the interior door to Hansen Cave. Monument staff will remove the existing gate and make necessary preparations for the site. The generator and the acetylene torches must be used outside of the cave. Only the stinger should be operating at the gate.

#### **Materials List:**

Item Description	Length need
4-inch flange angle iron bars with a 3/8-inch wall thickness	17 ft
1-½ inch angle iron bars	34 ft
1 inch steel rod	12 ft

### **Timpanogos Cave Gate**

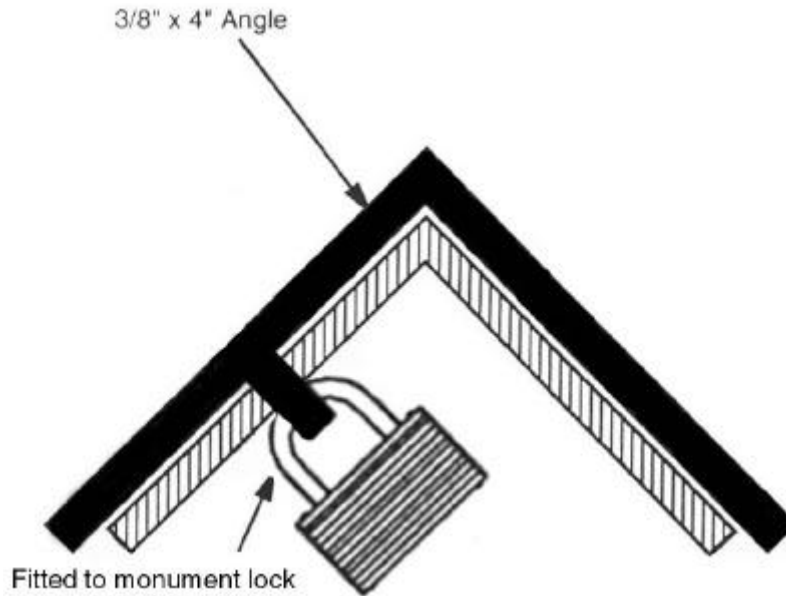
This gate will be placed just inside the door of the Timpanogos Cave Entrance behind a rock wall. This is the only gate where the ground is not bedrock. The staff will prepare the site by digging the floor to an appropriate depth (less than 2 ft) to begin constructing the gate. Monument staff will remove the old gate and wall after the gate is completed.

#### **Materials List:**

Item Description	Length need
4-inch flange angle iron bars with a 3/8-inch wall thickness	28 ft
1-½ inch angle iron bars	56 ft
1 inch steel rod	21 ft
Rebar	10 ft

## Middle Cave Gate

This site will be the most difficult due to its access problems. The entrance is located about 30 ft beyond the rock trap over a hundred from the trail. All of the equipment and materials will need to be winched up to the site. The gate will be located a few feet from the 115 ft drop into the main trail through Middle Cave. Workers will be required to use safety ropes. This entrance is where the electrical line feeds into the cave. For maintenance of electrical corridor and research purposes, a removable bar will be added for access (See Removable Bar Detail).

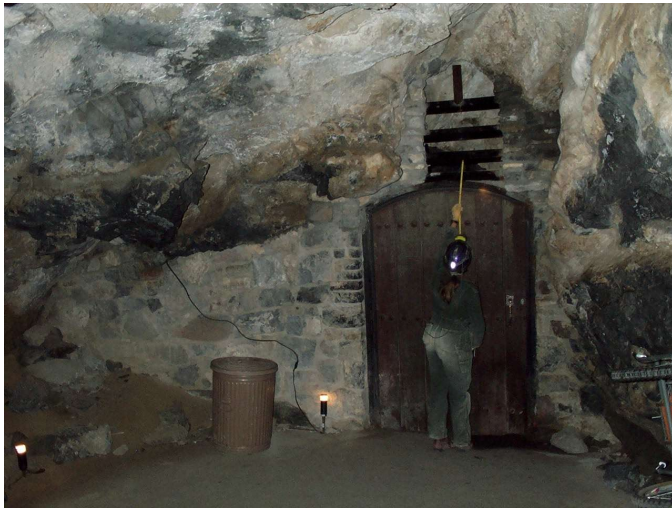


Removable Bar Detail

### Materials List:

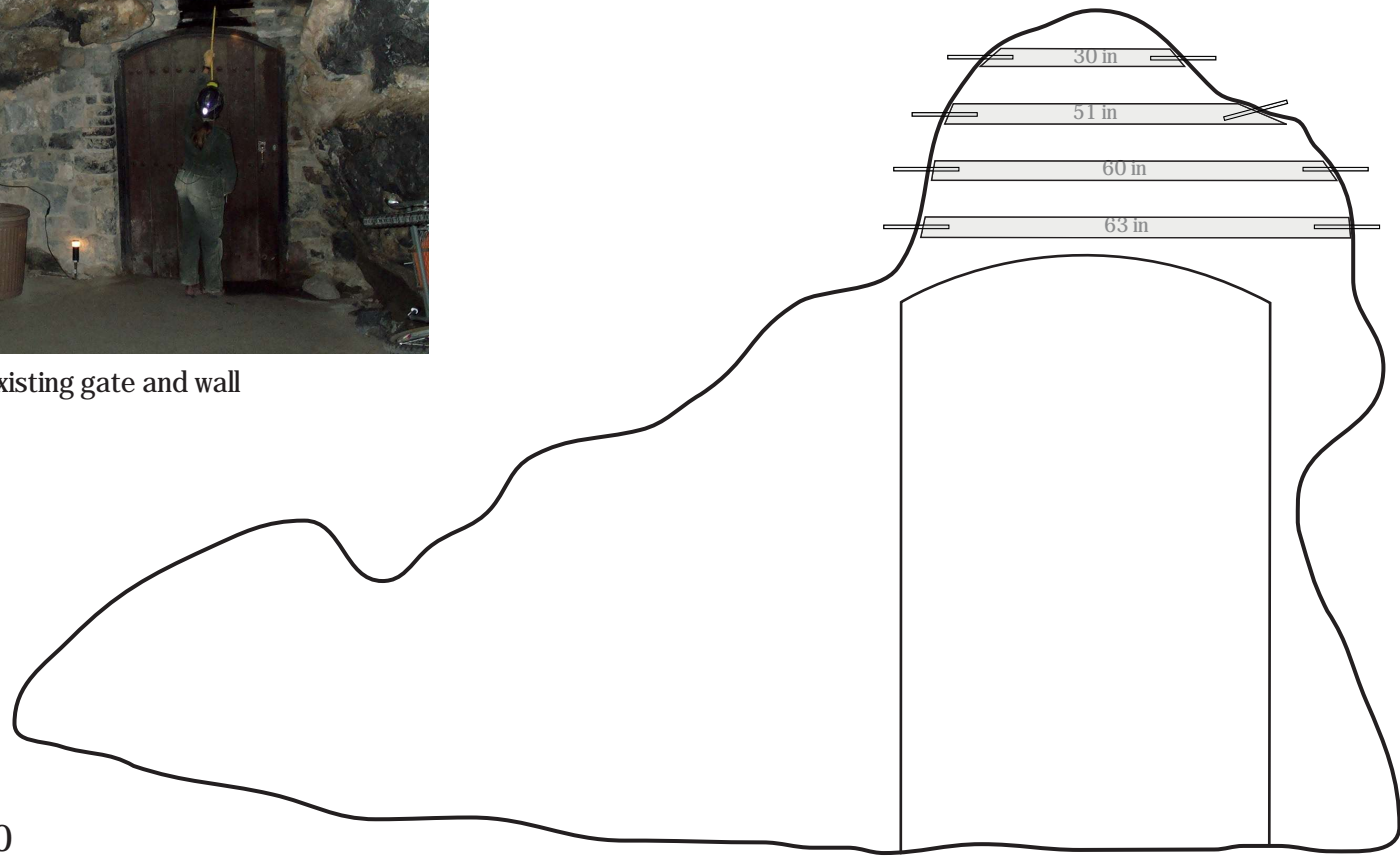
Item Description	Length need
4-inch flange angle iron bars with a 3/8-inch wall thickness	31 ft
1-1/2 inch angle iron bars	60 ft
1 inch steel rod	33 ft

# Hansen Cave Gate Design



Existing gate and wall

Scale 1:30

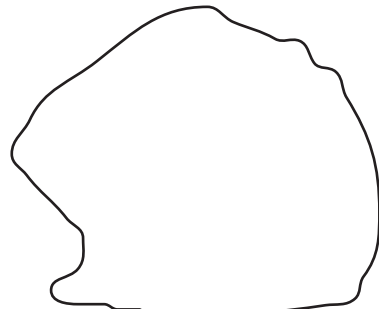


Proposed gate design

# Timpanogos Cave Gate Design

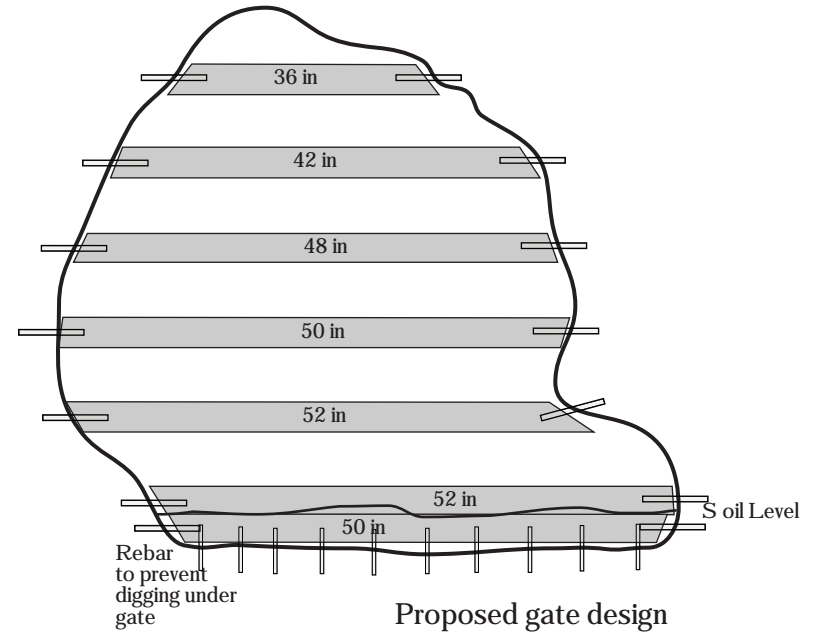


Proposed location for gate  
with wall to be removed



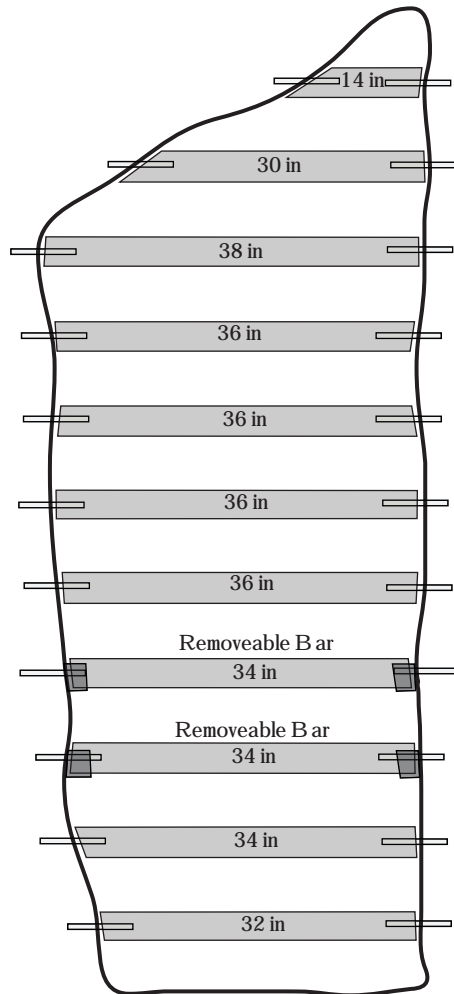
Existing Gate  
Cross-section

Scale 1:20



Existing Gate  
with line indicating where  
natural wall begins

# Middle Cave Gate Design



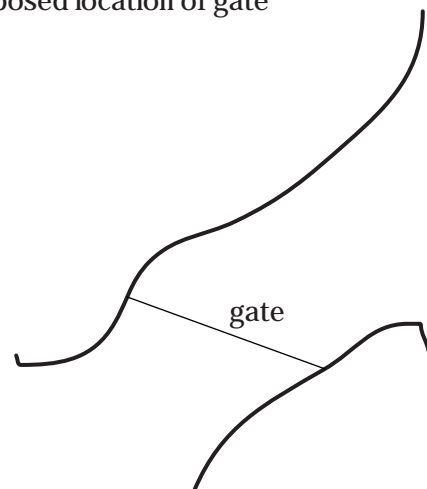
Proposed design of gate



Proposed location of gate



Existing gate



The existing gate's cross-section & profile

Scale 1:20

